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The low-temperature dynamic crossover in the dielectric relaxation of ice Ih

Popov I., Lunev I., Khamzin A., Greenbaum A., Gusev Y., Feldman Y.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2017 the Owner Societies. Based on the idea of defect migration as the principal mechanism in the dielectric relaxation of ice I h , the concept of low-temperature dynamic crossover was proposed. It is known that at high temperatures, the diffusion of Bjerrum and ionic defects is high and their movement may be considered to be independent. Simple switching between these two mechanisms leads to a dynamic crossover at ~235 K. By introducing coupling between the Bjerrum and ionic defects, it is possible to describe the smooth bend in the relaxation time at low temperatures in ice I h . However, because the mobility of Bjerrum orientation defects slows down at low temperatures, they may create blockages for proton hopping. The trapping of ionic defects by L-D defects for a long period of time leads to an increase in the relaxation time and causes a low-temperature crossover. This model was validated by experimental dielectric measurements using various temperature protocols.

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